Title: Re-Calibrating HIRS and Evaluating Associated Impact on Cloud and Moisture Properties

Investigator(s): **W. Paul Menzel (PI)**
Steve Ackerman, UW CIMSS
Bryan Baum, UW, Space Science and Engineering Center
Andrew Heidinger, NOAA
Robert Knuteson, UW, Space Science and Engineering Center
David Tobin, UW, Space Science and Engineering Center

Lead Institution: University of Wisconsin-Madison (UW), Cooperative Institute for Meteorological Satellite Studies (CIMSS)

The Cooperative Institute for Meteorological Satellite Studies (CIMSS) at the University of Wisconsin – Madison is proposing to establish a large Development Team to recalibrate all infrared measurements of High-Resolution Infrared Radiation Sounder (HIRS) against reference measurements from the Infrared Atmospheric Sounding Interferometer (IASI) on the European Meteorological Operational Satellite (METOP) platform. This work will reprocess the Fundamental Climate Data Record (FCDR) of Thermal Infrared Sounder Sensor Data Record (SDR) one year before and after a HIRS sensor transition and evaluate the impact of that reprocessing on cloud and moisture CDRs as part of the Scientific Data Stewardship of Climate Data Records.

CIMSS already has in-house experience with a 28 year record of HIRS data; we propose to use that expertise in re-calibrating the METOP infrared spectral bands on HIRS with IASI as the reference and then going backwards in time via simultaneous nadir overpasses (SNO) and intercomparisons with geostationary simultaneous observations (GSO) to establish accurate and well characterized calibrations for all HIRS (using those on METOP as the reference). The goal is to establish a consistent set of radiance measurements tied to modern absolute references. To accomplish the GSO intercomparison, CIMSS proposes to use IASI and AIRS (Atmospheric Infrared Sounder) to re-calibrate the geostationary (GEO) sounder infrared (IR) channels. This algorithm has been developed at CIMSS; the proposed effort will go backward in time to get consistent radiances on all the GEO sounders (radiosondes will be incorporated as necessary to assist). The use of GSOs will add additional sampling and statistics to the SNO calibration transfer approach. The in-house CIMSS/SSEC data holdings, coupled with the existing SSEC data processing system, enables efficient reprocessing that will enable investigation of diurnal effects on cloud and moisture 30-year trends.

The re-calibrated and characterized radiance measurements, along with algorithm advances established with the Moderate resolution Imaging Spectroradiometer (MODIS), will be used to reprocess the HIRS derived cloud products (particularly cloud amount, cloud top pressure, and associated error structures) and to produce climate quality atmospheric clear sky water vapor products (including total precipitable water, TPW, and upper tropospheric humidity, UTH). It has been found that relatively small changes in the HIRS radiances can translate into large differences in the cloud and water vapor products. The product consistency during transition periods from one sensor to another will be used as a measure of the recalibration.

Climate change is associated with changes in surface properties, cloud coverage, cloud properties, and tropospheric moisture. Large uncertainties still remain in the global and regional distributions of these parameters. The data sets resulting from this work are critical to setting a baseline satellite data sets that support IPCC observational needs.